US Tritium Activities

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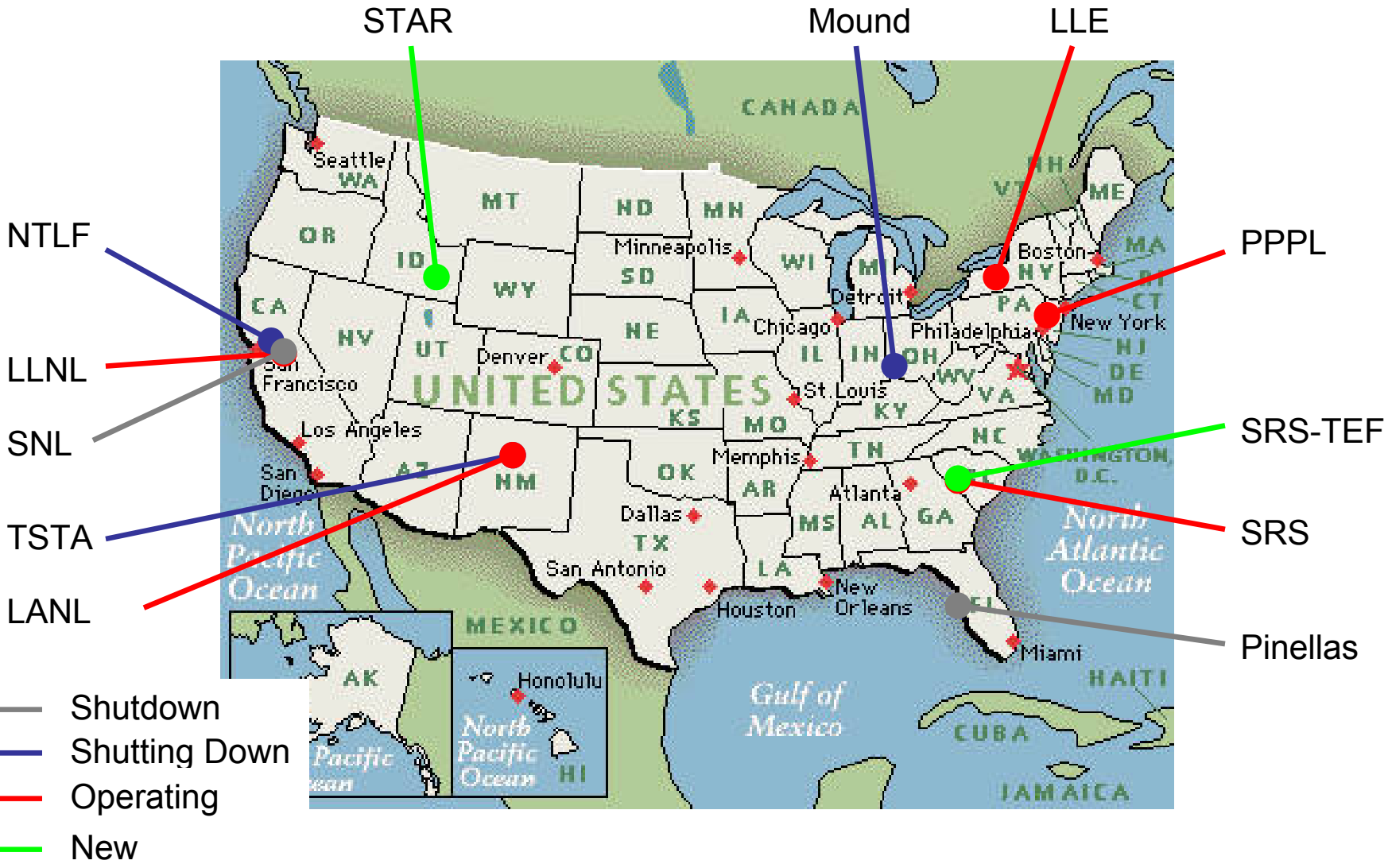
Major US tritium activities

- Inertial confinement fusion
- Fusion energy-magnetic and inertial
- Tritium facility decontamination and decommissioning
- Tritium production

Locations of major US tritium facilities



US tritium facilities status

- Shutdown completed
  - Sandia Livermore National Laboratory
  - Pinellas
- Shutting down
  - Mound Tritium Facilities-Mound Site
  - Tritium Systems Test Assembly-LANL
  - National Tritium Labelling Facility-LBNL
- Operating
  - Savannah River Site
  - Los Alamos National Laboratory
  - Lawrence Livermore National Laboratory
  - Omega Laser-U. of Rochester
  - Princeton Plasma Physics Laboratory
- New
  - Tritium Extraction Facility-SRS
  - Safety and Tritium Applications Research-INEEL

Mound Tritium Facilities

- **Location**: Mound Site, Miamisburg, Ohio
- **Owner:** Environmental Management
- **Purpose:** Performed (analytical, radioluminescence, inventory control) R&D with tritium
- **Recent work:** Facility stopped R&D operations in 1998; now undergoing D&D
- **Plans:** Site closure planned for 2006
- **Inventory:** ~60g tritium remain as process hold-up in hydride beds, zeolites, carbon traps, oils, organic residues
- **Operating Yrs:** Tritium:1957-98; Alpha:1948-80
- **Unique capability:** Wide-ranging tritium R&D

Nochar organics solidification

Tubing crimper

Tritium Systems Test Assembly

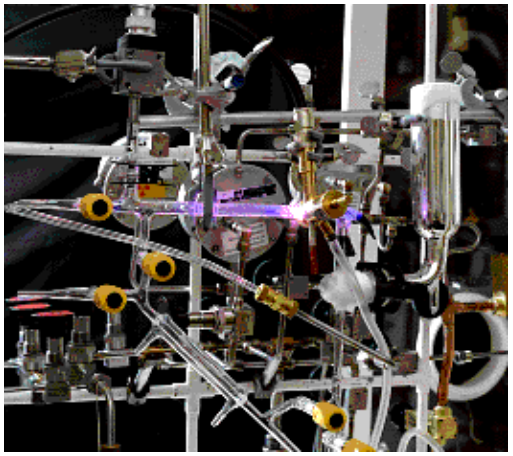
- **Location**: Los Alamos National Lab
- **Owner:** Office of Science
- **Purpose:** Develop and demonstrate fusion fuel cycle technologies
- **Recent work:** US/Japan collaboration: tested room cleanup system and isotope separation experiments with modeling
- **Plans:** SC plans to complete tritium removal and systems shutdown in 2003, then transfer facility to DOE Environmental Management for final closure
- **Inventory:** Was ~140 g, now ~20 g
- **Operating Yrs:** 1984-2001
- **Unique capability:** Integrated, full-scale fusion fuel cycle

TSTA

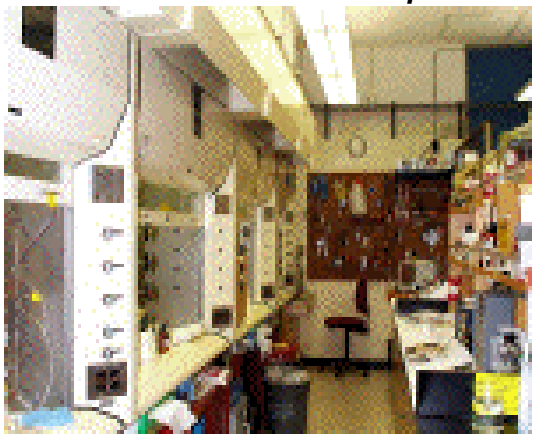
Recent HTO Waste Disposal by Burial

National Tritium Labelling Facility

- **Location**: Lawrence Berkeley National Laboratory
- **Owner:** US National Institutes of Health
- **Purpose:** Develop methods for incorporating tritium into compounds for chemistry and healthcare applications
- **Recent work:** Labelled compond preparation and mixed waste destruction. See www.lbl.gov/LBL-Programs/NTLF/
- **Plans:** This facility will be closed
- **Inventory:** <1.6 g
- **Operating Yrs:** 1982-present
- **Unique capability:** Biological tracer tritium R&D, tritium NMR spectroscopy, tritium labeling reagents, analysis of labeled compounds



Tritium microwave plasma

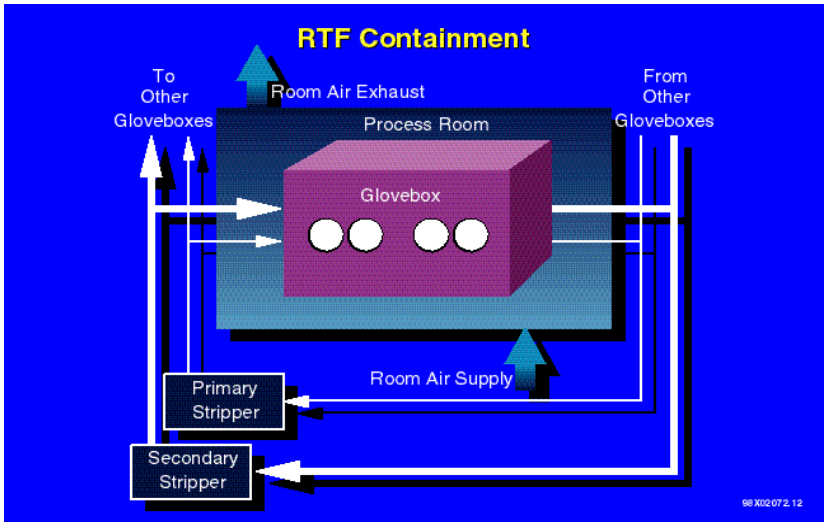


Radio-synthesis lab

SRS Buildings 233-H “Replacement Tritium Facility”

- **Location**: Savannah River Site
- **Owner:** NNSA
- **Purpose:** Work with tritium components
- **Recent work:** Updated control room to state of the art
- **Plans:** Add new processing capability to replace functions from older buildings
- **Inventory:** Very Large
- **Operating Yrs:** 1994-present
- **Unique capability:** Large-scale tritium plant

Hydride bed for isotope separation



Glovebox for tritium confinement

SRS Buildings 232 and 234H

- **Location**: Savannah River Site
- **Owner:** NNSA
- **Purpose:** Tritium processing to support 233H
- **Recent work:** Startup of PMR in 232H, shutdown of old extraction facility
- **Plans:** Consolidate into smaller number of buildings (move to 233H)
- **Inventory:** Very Large
- **Operating Yrs:** 1957-present
- **Unique capability:** Large-scale tritium plant

Palladium Membrane Reactor

Exhaust Stacks of Old Facilities

Tritium Science and Fabrication Facility, and WETF

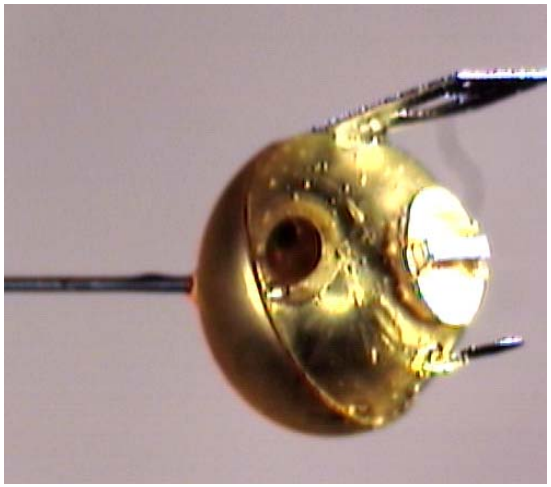
- **Location**: Los Alamos National Lab
- **Owner:** NNSA
- **Purpose:** Provide facilities for tritium R&D
- **Recent work:** WETF refurbishment and consolidation activities
- **Plans:** Close TSFF and consolidate all activities at WETF
- **Inventory:** Large
- **Operating Yrs:** 1974-present for TSFF and 1992-present for WETF
- **Unique capability:** Large inventory, high-pressure tritium capability

Tritium activities at TSFF

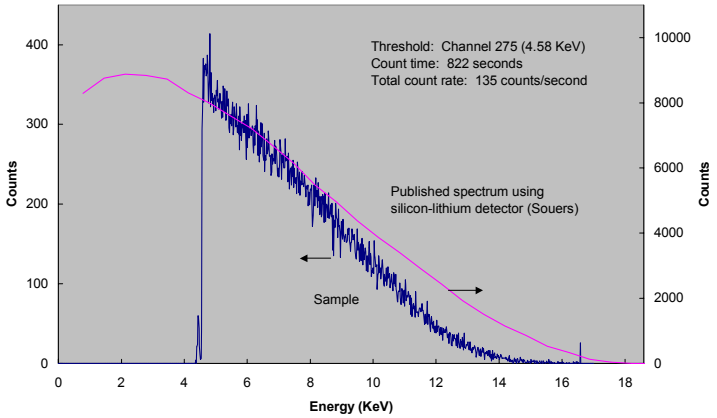
Construction at WETF

Target Fabrication Facility Tritium Laboratory

- **Location**: Los Alamos National Lab
- **Owner:** NNSA
- **Purpose:** Characterize, handle and mount tritium filled ICF targets. Characterize tritiated materials
- **Recent work:** Characterized TFTR tiles
- **Plans:** Continue present activities
- **Inventory:** <1.6 g
- **Operating Yrs:** 1988-present
- **Unique capability:** Tritiated ICF target handling and a variety of tritiated materials characterization techniques



2.4 mm dia. ICF Target



Tritium beta spectrum

LLNL Tritium Facility

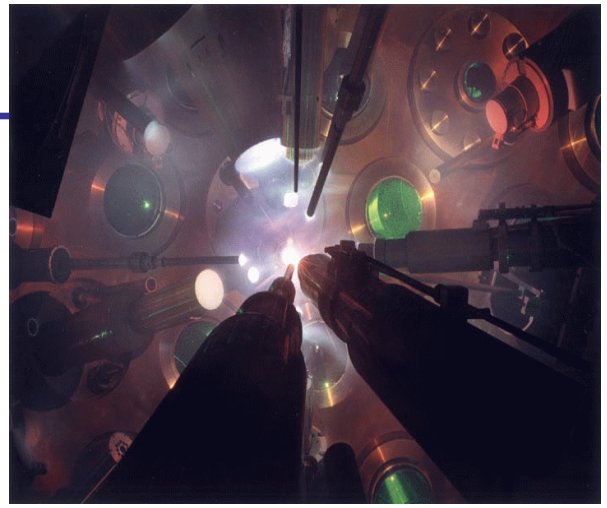
- **Location**: Lawrence Livermore National Laboratory
- **Owner:** NNSA
- **Purpose:** Provides support for LLNL tritium R&D needs
- **Recent work:** Tritium recovery & recycle of illumination tritium, UC-609 fleet maintenance, Mound D&D support
- **Plans:** Either the existing facility will be renovated or a new structure will built to modernize LLNL tritium capability
- **Inventory:** 30 g max. (Hazard Cat.3)
- **Operating Yrs:** 1958 - present
- **Unique capabilities:** Recycle of illumination device tritium, cryogenic ICF target fills (future)

LLNL Tritium Facility

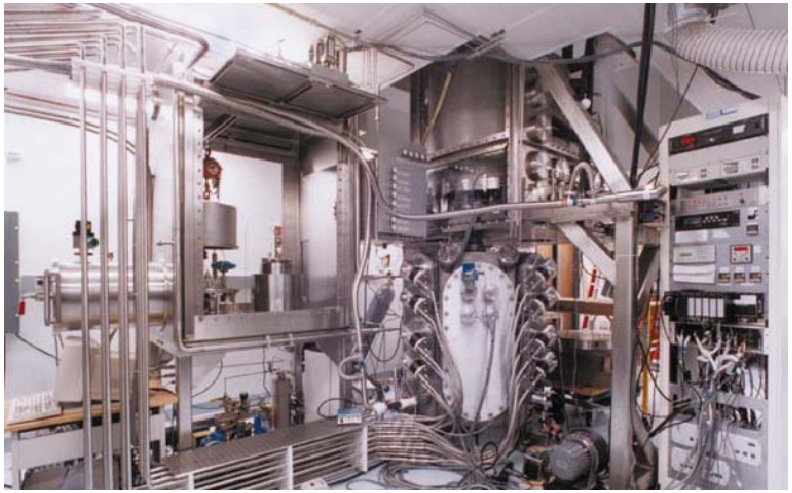
Portable Tritium Processing System

Omega Laser Tritium Facility

- **Location**: Laboratory for Laser Energetics at U. of Rochester
- **Owner:** NNSA
- **Purpose:** Tritium support for Inertial Confinement Fusion experiment at the OMEGA laser facility. Includes target filling and tritiated effluent processing
- **Recent work:** Implemented a cryogenic target delivery capability. Currently testing with deuterium and will transition to DT (~0.75 Ci/target).
- **Plans:** Upgrade the tritium recovery systems
- **Inventory:** 0.6 gm tritium (1.0gm license)
- **Operating Yrs:** 1995-present
- **Unique capability:** ICF target handling



Inside target chamber during cryogenic-capsule implosion

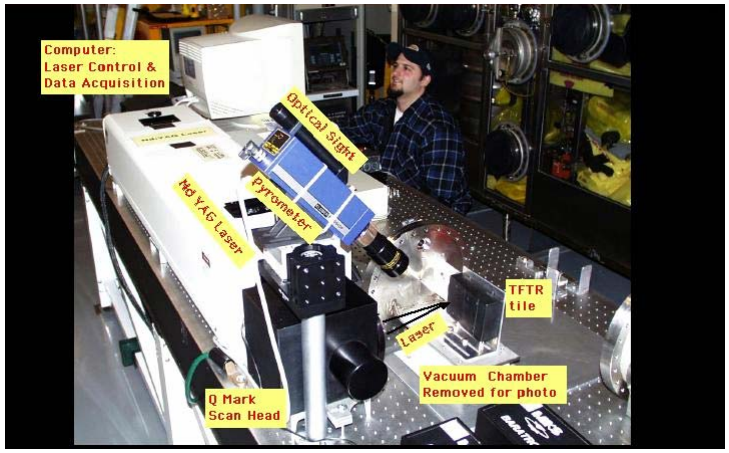


High pressure system for target filling

Princeton Plasma Physics Lab Tritium Facility

- **Location**: Princeton Plasma Physics Lab
- **Owner:** Office of Science
- **Purpose:** Supply, recover , and reprocess (ISS) tritium to TFTR and potential future PPPL devices
- **Recent work:** Supported TFTR D&D. Studied tritium D&D, tritium materials interactions, co-deposited layers on first wall materials.
- **Plans:** Complete TFTR D&D. Study tritium materials interactions.
- **Inventory:** Recently reduced from <5 g to <1.6 g
- **Operating Yrs:** 1993-present
- **Unique capability:** Tritium facility directly connected to a fusion reactor

Training for Vessel Entry



Nd:Yag Laser for tritium removal

Safety and Tritium Applications Research Facility

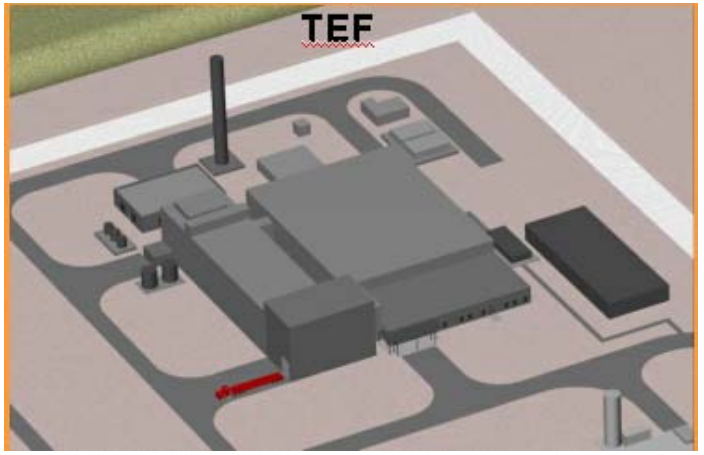
- **Location**: Idaho National Engineering and Environmental Lab
- **Owner:** Office of Science
- **Purpose:** Study fusion energy sciences tritium issues
- **Recent work:** Facility planning and building preparation. Recently established as DOE User Facility.
- **Plans:** Study chemistry and tritium behavior in molten salts. Study tritium plasma material interactions with the Tritium Plasma Experiment.
- **Inventory:** <1.6 g
- **Operating Yrs:** Planned for 2002
- **Unique capability:** TPE. Handle tritium and beryllium. Safety studies.

STAR Building 7/01

STAR Building 10/01

Tritium Extraction Facility

- **Location**: Savannah River Site
- **Owner:** NNSA
- **Purpose:** Recover tritium produced in a light water reactor
- **Recent work:** Foundation complete for underground portion
- **Plans:** Begin operation in 2006
- **Inventory:** Under construction
- **Operating Yrs:** 2006 start
- **Unique capability:** Tritium extraction furnaces

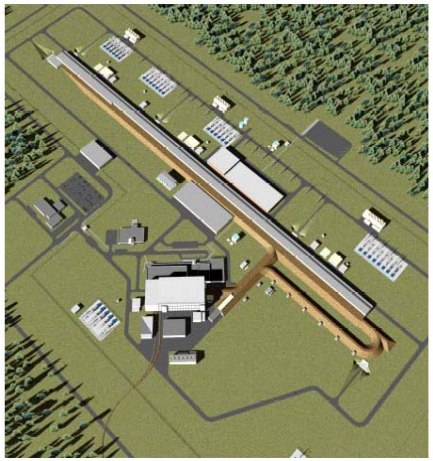


Artist's conception

Below grade construction 6/01

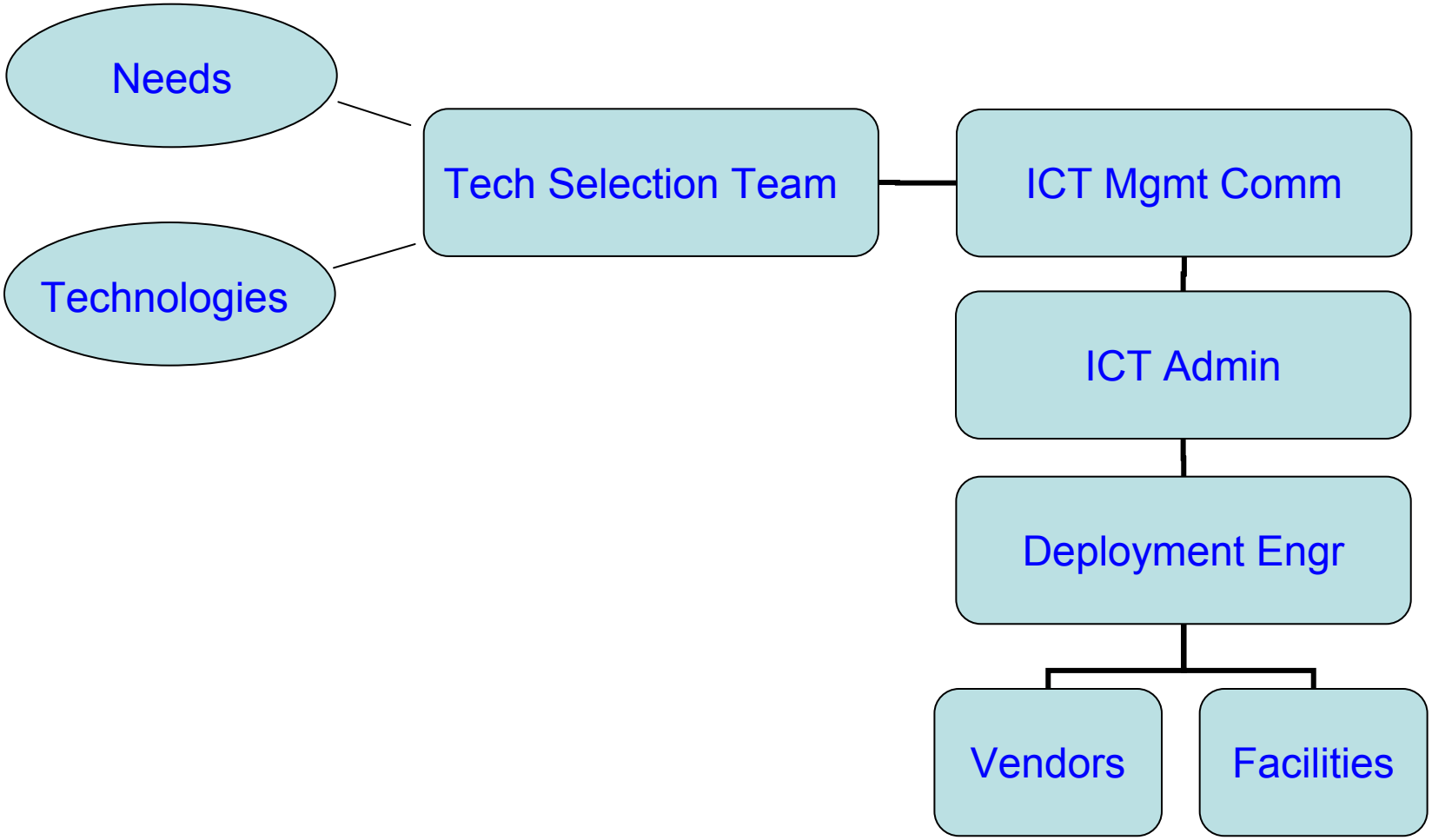
Tritium Production

- **Two options**—Accelerator Production of Tritium (APT) and light water reactor
- December 22, 1998—Light water reactor chosen as primary option
- **APT**
  - Project completed in US-FY01 with no further funding in FY02
  - Design has been completed and is available, if needed
- **Light water reactor**
  - Available to begin irradiation in 2003
  - No actual start date has been set
  - Li aluminate rods irradiated with neutrons, T captured on Zr getter, T extracted at SRS



APT Production Plant

The Large Scale Demonstration and Deployment Project deploys advanced technologies for DOE tritium facility shutdown



Summary

- Many of the US interests in tritium science and technology are the same as at the last tritium conference though there are some changes
  - Increased interest in Inertial Fusion Energy
  - No activity on the ITER project
  - Preparing for light water reactor tritium extraction
  - Increased interest in tritium facility shutdown
- The US tritium facility situation is changing with a considerable number of exiting facilities being shut down and some new facilities being constructed